APPROACH FOR OPERATOR DIRECTED ROUTING IN CONJUNCTION WITH AUTOMATIC PATH COMPLETION

[0001] This application claims the benefit of U.S. Provisional Application No. 60/391,405 filed June 26, 2002.

FIELD OF THE INVENTION

[0002] This invention relates to management systems for telecommunications networks and more particularly to methods of creating and routing lightpaths in an optical communications network.

BACKGROUND

[0003] Optical networks are essential in the ongoing development of high speed communications systems. An all-optical environment presents the potential for much higher bandwidth applications then possible by the conventional twisted pair systems. An optical communication network typically employs optical fibers between switching nodes where each fiber has the capability of simultaneously carrying multiple wavelength signals. When setting up an optical connection from a source to a destination across the network numerous factors need to be taken into consideration. These factors include but are not limited to speed and cost. Additionally, specific end users may have requirements that need to be factored and which may not relate to other inherent factors of the systems.

[0004] The ability to create end to end lightpaths through the network while accommodating the specific needs of its users is an essential feature of the design of NMS. Preferably the process of creating lightpaths should allow flexibility so that the above can be satisfied. Within an optical communication network the design of a network management system (NMS) is critical in the creation and routing of lightpaths within a network. Current approaches for creating lightpaths

in a wavelength transparent mesh optical network or other types of network topologies such as synchronized optical network (SONET) are restricted in that:

1. Lightpaths are typically pre-defined according to rigid network-design constraints. The choices of paths and wavelengths are therefore limited. Once a path has been selected, the operator is unable to change the corresponding wavelengths defined for the path.
2. The path selection process is completely manual or completely automatic.
3. Operators cannot override the wavelengths selected through automatic routing.

[0005] Therefore, there is a need for systems and methods of creating and routing lightpaths in an optical communications network that provides an operator with the flexibility to tailor the lightpath to meet users' needs.

SUMMARY OF THE INVENTION

[0006] The problem solved by this invention is the definition of a well defined approach for creating lightpaths that uses a combination of both operator directed routing and automatic routing and allows the operator to change, at any point during the creation of the lightpath, the wavelength for any segment of the path. The key advantage of this approach is that it allows the operator to customize the lightpath to suit special end-customer needs or special networking requirements.

[0007] The operator can utilize automatic routing algorithms to provide recommended wavelength selections and routing then, in the same operation, manually reject and select different wavelengths for some or all of the wavelengths in the lightpath.

[0008] Therefore in accordance with a first aspect of the present invention there is provided a method of creating a lightpath between a source and destination in an

optical communication system comprising: selecting a lightpath parameter; selecting lightpath endpoints; and automatically completing the lightpath.

[0009] In accordance with a second aspect of the invention there is provided a network management system (NMS) for creating a lightpath between a source and a destination in an optical communication system, the NMS comprising: means for viewing and selecting lightpath parameters; means for viewing and selecting lightpath endpoints at the source and destination; and means for completing the lightpath through intermediate nodes.

BRIEF DESRIPTION OF THE DRAWINGS

[0010] The invention will now be described in greater detail with reference to the attached drawings;

[0011] Figure 1 is a flow chart of the approach for creating a lightpath according to the present invention;

[0012] Figure 2 is a snap shot of a possible user interface used for selecting lightpath parameters; and

[0013] Figure 3 is a snap shot of a possible user interface used for selecting lightpath endpoints.

DETAILED DESCRIPTION OF THE INVENTION

[0014] There currently is no defined flexible approach for helping operators to create lightpaths in a wavelength transparent meshed optical network. The shortcomings of the current approaches include:

1. Existing implementations do not allow operators to override recommended routing and wavelength choices by automatic routing algorithms. Makes custom engineering difficult.
2. 'Manual-only' routing choices can be difficult to make in mesh network configurations.
3. Insufficient flexibility to support special custom routing choices after determining the cheapest or shortest routes. ' The shortest is not always the preferred routing.'

[0015] The framework combines the use of both operator directed routing and automatic routing using an algorithm. The automatic routing feature can be used at any point during the lightpath creation to complete the path. The automatic routing feature can, for each segment of the path, restrict the wavelength selection to a given range and support routing disjoint from other selected paths.
The proposed approach for creating a light path is illustrated in the flowchart of figure 1. The approach can be broken down into three steps:

1. The selection of the lightpath parameters.
2. The selection of the lightpath end-points.
3. Automatic completion of the lightpath.

Step 1: Light Path Parameters Selection

[0016] This step involves the selection of the basic parameters associated with the lightpath. These are:

1. The lightpath name.
2. The lightpath protocol and bit rate.

3. The light path source node lambda end-point.
4. The light path destination node lambda end-point.

[0017] The selection of the source and destination lambdas is essential before proceeding to the next step. A snapshot of a possible user interface used for selecting the light path parameters is presented at figure 2.

Step 2: Light Path End-Points Selection

[0018] This step involves the selection of the nodes and corresponding wavelengths or lambdas that the lightpath will traverse. Visually the operator is presented with an interface resembling a two-column table. The first column shows the list of nodes that the operator has selected. Those are the nodes traversed by the lightpath. The second column has, for each node selection, the list of lambdas that lead to the previous node i.e. one row above starting with the source node selected at the first step. A snapshot of a possible user interface used for selecting the light path end-points is presented at figure 3.

[0019] The node selection process takes a "where do you want to go next" approach. By knowing the last node selected by the operator, it is possible to determine the set of nodes to which this node is connected thus limiting the list of potential choices for the operator. Similarly, once the user has selected a node, it is possible to narrow the choices of possible lambdas to only those present between this node and the previous one. When the operator selects the destination node as the next node, the operator is unable to select any more nodes and the light path can be created.

Step 3: Automatic Completion of the Lightpath

[0020] At any point during the selection process the operator can:

1. Ask to automatically complete the path.

2. Modify the choice of lambda used for any node selection.

[0021] The operator has two options to automatically complete a path. A default automatic completion will simply analyze the network and determine if connectivity exists between the source and destination nodes, regardless of the nature of the lambdas between these nodes. A variant of the automatic completion approach will allow the operator to restrict the selection of lambdas to a give wavelength range and/or to keep the path disjoint from a selection of already created paths. An algorithm is used to complete the path and, if a path exists, the list of nodes is automatically populated with the results.

[0022] Although specific embodiments of the present invention have been described and illustrated it will be apparent to one skilled in the art that numerous changes can be made without departing from the basic concept. It is to be understood, however, that such changes will fall within the full scope of the invention as defined by the appended claims.